REMARKS

Claims 2, 12-15, 17-19 and 31 have been canceled, and new claims 34-38 have been added. No new matter was added. Accordingly, claims 30 and 32-38 are pending for further prosecution. Independent claim 30 has been amended to distinguish over the prior art of record. Applicant respectfully submits that the present application is in condition for allowance.

I. Claim Rejections - 35 USC §103(a)

A. In the FINAL Office Action dated September 23, 2008, claims 2, 12-15 and 17-19 are rejected under 35 USC §103(a) as being obvious over U.S. Patent No. 6,331,233 B1 issued to Turner.

Claims 2, 12-15 and 17-19 have been canceled. Accordingly, Applicant respectfully submits that this rejection is now moot and can be withdrawn.

Further, claims 30 and 32-38 of the present application all require a method starting with a Ta raw material of a purity of 4N5 (99.995%) or higher. Turner fails to provide such a disclosure. (See column 3, lines 5-6, of Turner.)

To produce a target of the quality required by the present invention, it is necessary to increase the purity of the starting tantalum raw material. As a result of using this level of purity of raw material, it becomes necessary to reduce abnormal changes in the structure (i.e. uneven macrostructure, such as caused by the existence of heterophase and irregular crystal grains). At the time of the present invention, the presence of these structures was not acknowledged as a problem.

Accordingly, Applicant respectfully submits that at the time the invention was made, it would not have been obvious for one of ordinary skill in the art to arbitrarily select processing conditions, a set of annealing temperatures, and crystal grain sizes based on Turner. This is because Turner fails to disclose the level of purity and problems of using such raw material and

because Turner does not recognize or acknowledge the problems with abnormal structure (i.e. uneven macrostructure) being easily formed on a target prepared of a tantalum raw material having a purity of 4N5 or higher. Since the problem is not known or addressed by Turner, then Turner clearly cannot render obvious the objective and solution provided by the present invention as now claimed in the present application.

Applicant respectfully requests reconsideration and removal of the above referenced rejection.

B. *In the FINAL Office Action dated September 23, 2008, claims 30-33 are rejected under 35 USC §103(a) as being obvious over U.S. Patent No. 6,348,113 B1 issued to Michaluk et al.*

Turning first to the present invention, the following problems are noted on page 2, lines 6-26, of the present application, as filed, with respect to tantalum sputtering targets manufactured by conventional methods:

> "… with the conventional forging and annealing manufacturing method, this is a problem in that a pattern in the form of ***wrinkles or streaks*** is formed form the center to the peripheral edge of the disk. … ***heterophase crystal grains*** gathered in the form of wrinkles were observed in a part of the ordinary structure. … Therefore, the existence of ***irregular crystal grains*** in the target that are generated during forging, rolling or the annealing to be performed thereafter will change sputtering rate, and there is a problem in that evenness (uniformity) of the film will be affected, generation of arcing and particles will be promoted, and the quality of sputtered deposition may deteriorate thereby. Further, if a forged product with stress remaining therein is used as is, the quality will deteriorate, and this must be avoided at all costs. Accordingly, with the conventional forging and annealing process, there is a problem in that ***irregular crystal grains*** will be generated in the Ta sputtering target, and the quality of the film will deteriorate as a result thereof."

As best stated on page 2, lines 30-31, of the present application, as filed, the present invention was devised to overcome the above referenced problems with respect to wrinkles, streaks, heterophase crystal grains and irregular crystal grains.

The cause of the above referenced problems is best stated on page 4, line 31, to page 5, line 10, of the present application, as filed, as follows:

> "Upon examining the cause of the generation of heterophase crystal grains gathered in the form of wrinkles during the manufacturing process of conventional technology, even upon performing hot forging and recrystallization annealing thereafter, ***primary crystal grains (roughly 50mm) remained*** in the ingot or billet, and with a recrystallization temperature of roughly 1173K (900°C), it looks as though the ***recrystallized grains are merely generating in the primary crystal grains***. In other words, although it looks as though the primary crystal grains are crushed with the forging step and mostly eliminated, with the subsequent recrystallization temperature of roughly 1173K, ***the destruction of the primary crystals is incomplete, and it is considered that a part of this remains as traces of the primary crystal***. This is not eliminated even with the subsequent forging and recrystallization annealing steps, and, this is considered to be become heterophase crystal grains gathered in the form of wrinkles at the final stage of finish processing."

Accordingly, the primary objective of the present invention is to devise a method by which the primary crystal grains of the billet or ingot cast from tantalum raw material of 4N5 or greater purity are completely destroyed and eliminated with no traces of the primary crystal remaining. This in turn will ensure that recrystallized grains are not merely generating in the primary crystal grains. Thus, the method according to the present invention eliminates the existence of heterophase and irregular crystal grains and the wrinkles and/or streaks caused thereby.

Turning to Michaluk et al., it fails to disclose the above referenced problem and certainly fails to disclose a solution to the problem. Accordingly, Applicant respectfully submits that it would not be obvious to one of ordinary skill in the art to overcome the above referenced problems based on the teachings and disclosure provided by the Michaluk et al. patent.

Michaluk et al. discloses two different manufacturing processes for a sputtering target, one relating to the processing of an "ingot" and a separate one relating to the processing of a "billet".

With respect to the processing of an "ingot", Michaluk et al. starts with a raw material of tantalum of a purity of only 99.5 (2N5) to 99.99% (4N) (see column 6, lines 3-4, of Michaluk et al.). The cast ingot is subjected to "flat forging" to form a "rolling slab" (see column 7, lines 9-10). The "rolling slab" is annealed at a temperature of 950 to 1500°C (1223 to 1773K) (see column 7, lines 32-33). The "rolling slab" is then subjected to cross-rolling and level rolling to produce a "plate" (see column 7, lines 17-22). A final annealing is performed on the "plate" at a temperature of 950 to 1150°C (1223 to 1423K) (see column 7, line 22, and the temperatures disclosed in Table 3 under the heading "Plate Anneal Temperature (°C)").

Applicant respectfully submits that the above "ingot" method disclosed by Michaluk et al. fails to disclose or obviate the method claimed by the present application and certainly fails to provide the results and quality of sputtering target provided by the method claimed by the present application.

Independent claim 30, as amended, of the present application requires starting with a Ta raw material of 4N5 purity or greater and, in sequence, the steps of: forging; annealing at 1373 to 1673K (1100 to 1400°C); forging; annealing at 1373 to 1673K (1100 to 1400°C); forging or rolling; annealing at a temperature between a recrystallization staring temperature and 1373K (1100°C). No new matter was added; for example, see the limitations previously stated in claim 31 and see page 5, lines 21-29, and Examples 1-3 of the present application, as filed.

The "ingot" method of Michaluk et al. requires only one forging step (i.e. "flat forging of the "cast ingot" to form a "rolling slab"). Claim 30 of the present application requires at least two forging steps. The "ingot" method of Michaluk et al. requires only two annealing steps (i.e. annealing of the "rolling slab" before rolling and final annealing of the "plate" after rolling). Claim 30 of the present application requires at least three annealing steps. Further, one of ordinary skill in the art is not provided with any common sense reason for modifying the

processing conditions of Michaluk et al.; because, as stated above, Michaluk et al. does not recognize or acknowledge the problems with abnormal structure (i.e. uneven macrostructure) being easily formed on a target prepared of a tantalum raw material having a purity of 4N5 or higher. Since the problem is not known or addressed by Michaluk et al., Michaluk et al. clearly cannot render obvious the objective and solution provided by the present invention as now claimed in the present application.

New method claims 34-38 of the present application provide further limitations with respect to such a method. No new matter was added; for example, see: page 4, line 34; page 5, lines 21-29; page 6, line 14; and Examples 1-3 on page 6, line 22, to page 9, line 2, of the present application, as filed. Accordingly, these claims provide additional reasons for patentability over the Michaluk et al. patent.

With respect to the processing of a "billet", Michaluk et al. starts with a rod and cuts it to form a billet (see column 7, lines 53-54). As an option, the cut billet can be subjected to annealing or alternatively can remain unannealed (see column 7, lines 55-56, and compare annealed Billets "A" & "B" with unannealed Billets "C" & "D" in Table 4). Billets "A" & "B" are disclosed as being annealed at 1050°C (1323K). The "billet" is then subjected to axial or upset forging to produce a "preform" (see column 7, line 57, and Table 4). As an option, the "preform" can be subjected to annealing or alternatively can remain unannealed (see column 7, lines 57-58, and compare annealed Billets "A" & "C" with unannealed Billets "B" & "D" in Table 4). The preform made from Billets "A" & "C" are disclosed as being annealed at 1050°C (1323K) in Table 4; however, column 8, lines 4-6, disclose a temperature of 900 to 1200°C (1173-1473K). The preform is subject to rolling to produce a "plate" (see column 7, lines 60-61). A final annealing is performed on the "plate" at a temperature of 950 to 1100°C (1223 to

1373K) (see column 7, lines 63-64, and the temperatures disclosed in Table 4 under the heading "Anneal Temp (°C)").

As discussed above, independent claim 30, as amended, of the present application requires starting with a Ta raw material of 4N5 purity or greater and, in sequence, the steps of: forging; annealing at 1373 to 1673K (1100 to 1400°C); forging; annealing at 1373 to 1673K (1100 to 1400°C); forging or rolling; annealing at a temperature between a recrystallization staring temperature and 1373K (1100°C).

The "billet" method of Michaluk et al. requires only one forging step after a billet is formed (i.e. "axial" or "upset" forging of the "cut billet" to form a "preform"). Claim 30 of the present application requires at least two forging steps. The "billet" method of Michaluk et al. requires optional annealing steps. For instance, Billet "D" of Table 4 requires only one final annealing step, and Billet "B" & "C" requires only two annealing steps. Billet "A" is the only example that discloses three annealing steps; however, the disclosed temperatures are 1050°C (1323K), 1050°C (1323K), and a final anneal of 950 to 1100°C (1223 to 1373K). Thus, these do not fall within, or obviate, the ranges required by claim 30.

Further, one of ordinary skill in the art is not provided with any common sense reason for modifying the processing conditions of Michaluk et al.; because, as stated above, Michaluk et al. does not recognize or acknowledge the problems with abnormal structure (i.e. uneven macrostructure) being easily formed on a target prepared of a tantalum raw material having a purity of 4N5 or higher. Since the problem is not known or addressed by Michaluk et al., it clearly cannot render obvious the objective and solution provided by the present invention as now claimed in the present application.

New method claims 34-38 of the present application provide further limitations with respect to such a method. Accordingly, these claims provide additional reasons for patentability over the Michaluk et al. patent.

For the above reasons, Applicant respectfully requests reconsideration and removal of the above referenced rejection based on the Michaluk et al. patent.

II. Conclusion

In view of the above amendments and remarks, Applicant respectfully submits that the claim rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

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